Nickel Oxide

(ACCORDING TO EC-REGULATION 1907/2006 (REACH) & 1272/2008 (CLP))

1. Identification of the Substance and Company

1.1 Product Identification:
Product Name: Nickel Oxide
Synonyms: nickel oxide sinter 75, NOS75, Nickel oxide (NiO), FMW, green nickel oxide, black nickel oxide, mononickel oxide, nickel monooxide, nickelous oxide, nickel (II) oxide, nickel (2+) oxide, Bunsenite

EC No: 215-215-7 / 234-323-5
CAS No: 1313-99-1 / 11099-02-8
REACH Registration number: see Section 3

1.2 Uses
Identified Uses:

- Industrial use of powdered and shaped nickel oxide containing catalysts (A)
- Industrial use of nickel oxide-containing catalysts for the production of catalysts containing other nickel compounds (B)
- Production of nickel based powders from nickel oxide
- Production of nickel-containing electronics and thermally functioning ceramics
- Production of nickel-containing enamel frits
- Production of nickel-containing pigments
- Production of nickel-containing glass
- Stainless, special steels and special alloys manufacturing

Uses Advised Against: None Identified.

Exposure Scenarios: See Annex 1

1.3 Company Identification
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REACH@vale.com

Telephone Number: +44 (0) 1792 842501
For Fire, Spill, or chemical emergency call CHEMTREC: +44 (0) 2033 180470

2. Hazards Identification

Classification according to Part 3 of Annex VI of EU Regulation No. 1272/2008

2.1 Classification of the Substance:

2.1.1 Classification according Regulation (EC) No. 1272/2008
Skin Sensitization – Category 1;
Carcinogenicity – Category 1A; Specific Target Organ Toxicity, Repeated exposure – Category 1
Aquatic Chronic – Category 4

Hazard Pictograms: GHS07 - Exclamation mark, GHS08 - Health Hazard

Signal Word: Danger

Hazard Statements: H317 - May cause an allergic skin reaction.
H350 - May cause cancer by inhalation
H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
H413 - May cause long lasting harmful effects to aquatic life.

Precautionary Statements: P201, P202, P260, P261, P264, P270, P272, P273, P280, P281, P302+P352, P308+P313, P333+P313, P314, P321, P363, P405, P501

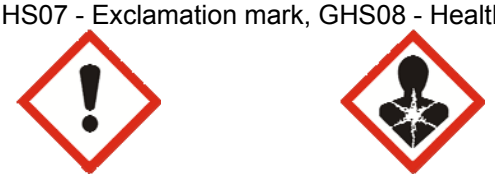
2.1.2. Classification according to Directive 67/548/EEC
Carc. Cat. 1; R49
T; R48/23
R43
R53

2.2: Label elements

Labeling according to Regulation (EC) No 1272/2008

Product identifier: Nickel Oxide
CAS #: 1313-99-1 / 11099-02-8

Symbols: GHS07 - Exclamation mark, GHS08 - Health Hazard



Signal Word: Danger

Hazard Statements: H317, H350, H372, H413

Precautionary Statements *(NOTE: number of P-statements has been reduced, as per CLP regulation, the full list can be found in Section 15)*.
P202, P261, P273, P281, P302+P352, P501

For full text of R-Statements and Precautionary statements see section 15.

3. Composition

☒ **Substance** ☐ **Mixture**
Typical Analysis:

Hazardous Ingredients	Typical Composition (%)	C.A.S. Number	EINECS/EC Label No.
Nickel Oxide (NiO)	98	1313-99-1	215-215-7
Cobaltous Oxide (CoO)	0 - 1.5	1307-96-6	215-154-6
Nickel hydroxide	0 – 0.5	12054-48-7	235-008-05

REACH Registration #'s:
01-2119467172-41-0000 – LR; Vale Europe Limited
01-2119467172-41-0005 – OR; Vale Japan Limited

4. First Aid Measures

Ingestion:	No specific first aid required.
Inhalation:	No specific first aid required.
Skin:	Remove contaminated clothing, and wash affected areas thoroughly with soap and water. If skin irritation or rash occurs: Get medical advice/attention. Show label if possible.
Eyes:	Irrigate eyeball thoroughly with water for at least 10 minutes. If discomfort persists seek medical attention.
Most important symptoms and affects, both acute and delayed	Skin contact: Rash Eye contact: Redness
Indication of immediate medical attention and special treatment needed	No special requirements

5. Fire Fighting Measures

Suitable extinguishing media:	Any, type to be selected according to materials stored in the immediate neighborhood.
Special risks:	Non-flammable. Extinguish surrounding fires with appropriate methods.
Special protective equipment for fire fighting:	None needed. Wear protective equipment if required for other materials within the immediate vicinity.

6. Accidental Release Measures

Person related precautionary measures:	Avoid generation of dusty atmospheres. Do not inhale dusts. Contaminated work clothing should not be allowed out of the workplace. Use personal protective equipment as required. Wash hands, and face thoroughly after handling.
Environmental Protection measures:	Spillages and uncontrolled discharges must be prevented from entering waterways.
Procedures for cleaning/absorption:	Pick up and replace in original container. Nickel-containing material is normally collected to recover nickel values.

7. Handling And Storage

7.1 Precautions for Safe Handling:	Prevent the generation of inhalable dusts e.g. by the use of suitable ventilation. Do not inhale dust. Wear appropriate nationally approved respirators if handling is likely to cause the concentration limits of airborne nickel to exceed the locally prescribed exposure limits. Wear suitable protective clothing and gloves. Contaminated work clothing should not be allowed out of the workplace
7.2 Conditions for Safe Storage:	Keep in the container supplied, and keep container closed when not in use. Local regulations should be followed regarding the storage of this product.

8. Exposure Controls / Personal Protection

8.1.1 Exposure Limits:

Nickel Oxide (NiO) – CAS 1313-99-1		
	Exposure Limit (mg/m^3)	Year
ACGIH TLV-TWA [1]	0.2 * ‡ as Ni	2008
UK WEL [2]	0.5 as Ni	2006
Japan	1 as Ni	1968
Korea	0.1 as Ni	2006
China	1 as Ni	2007

* Inhalable fraction
‡ Insoluble inorganic fraction

8.1.2 Environmental Limits:

PNEC's

Compartment	Unit	PNEC
Freshwater	µg Ni/L (bioavailable)	3.55
Marine	µg Ni/L	8.6
Terrestrial	mg Ni/kg	29.9

DNEL's

	Unit	DNEL
Dermal		
Acute systemic	mgNi/kg/day	-
Acute local	$mgNi/cm^2/day$	-
Long-term systemic	mgNi/kg/day	-
Long-term local	$mgNi/cm^2/day$	0.024
Inhalation		
Acute systemic	$mgNi/m^3$	520
Acute local	$mgNi/m^3$	3.9[1]
Long-term systemic	$mgNi/m^3$	0.05[2 3]
Long-term local	$mgNi/m^3$	0.05[2 3]

[1] Based on MMAD of 2.9 µm, increases with increasing MMAD (estimated as ≥6.4 mg Ni/m^3 for exposures to particles with a MMAD of ≥30 µm.
[2] When handling powders of particle aerodynamic equivalent diameter (AED) below 10 µm, exposures (8h TWA) to these powders should be kept under 0.01 mg Ni/m^3.
[3] When exposure are solely to metallic and nickel oxides (without exposure to any other nickel compounds) and the mean particle size of the aerosol is greater than 10 µm AED (≤ 10% of aerosol mass in respirable fraction), inhalable exposure levels up to 0.2 mg Ni/m^3 could be reasonably assumed to be safe.

8.2.1 Occupational exposure controls:

Do not inhale dust. Mechanical extraction ventilation may be required if user operations change it to other physical or chemical forms, whether as end products, intermediates or fugitive emissions, which are inhalable. Maintain airborne nickel levels as low as possible. Avoid repeated skin contact.

PPE

Respiratory protection: If required, use an approved respirator with particulate filters.

Eye protection: None

Hand & Skin Protection: Wear suitable protective clothing and gloves, which should be selected specifically for the working place, depending on concentration and quantity of the hazardous material (overalls and leather/rubber gloves). Wash skin thoroughly after handling and before eating, drinking or smoking. Change contaminated clothing frequently. Launder clothing and gloves as needed. Use of skin-protective barrier cream advised.

9. Physical And Chemical Properties

Solid, granular dark grey material.

Physical state at 20°C and 101.3 kPa	solid
Melting / freezing point	>1900°C
Boiling point	Not applicable
Relative density	6.75 g/cm^3 at 20°C
Vapour pressure	Not applicable
Surface tension	Not applicable
Water solubility	3.52X10^{-5} g/l at 20°C (green nickel oxide) 2.26X10^{-3} g/l at 20°C (black nickel oxide)
Partition coefficient n-octanol/water (log value)	Not applicable
Flash point	Not applicable
Flammability	Non-flammable
Explosive properties	Not applicable
Self-ignition temperature	>400°C
Oxidising properties	Non-oxidising
Granulometry	<0.1% of particles with a diameter <100 um
Stability in organic solvents and identity of relevant degradation products	Not applicable
Dissociation constant	Not applicable
Viscosity	Not applicable

10. Stability And Reactivity

10.1	Reactivity	Stable under normal conditions.
10.2	Chemical stability	Stable under normal conditions.
10.3	Possibility of hazardous reactions	Stable under normal conditions.
10.4	Conditions to avoid	None.
10.5	Incompatible materials	None.
10.6	Hazardous Decomposition Product(s)	No information available

11. Toxicological Information

As a mixture the toxicological properties of this product are unknown. The toxicology of the reported ingredients are summarized below.

Nickel Oxide

Acute Toxicity:

a) Oral: Non toxic - LD_{50} ORAL RAT >11,000 mg/kg (green); 9,990 (black)

b) Inhalation: Non toxic - LD_{50} INHAL RAT >5.08 mg/m^3 (green); >5.15 mg/m^3 (black)

c) Dermal: No information available.

Corrosivity/Irritation:

a) Respiratory Tract: No classification

b) Skin: Not corrosive/irritating.

c) Eyes: Mildly irritating.

Sensitization:

a) Respiratory tract: Nickel metal induced asthma is very rare. 3 case reports are available; the data is not sufficient to conclude that nickel metal is classified as a respiratory sensitizer.

b) Skin: Ni oxide is currently classified as a dermal sensitizer (R43) according to the 1st ATP to the CLP Regulation. Recent studies evaluating the bioaccessibility of a series of Ni compounds in synthetic sweat indicated very low nickel ion release from Ni oxide suggesting very low or no sensitization potency. Early Guinea pig maximization and Beuhler test results show low potential for nickel oxide to act as a dermal sensitizer.

c) Preexisting conditions: Individuals known to be allergic to nickel should avoid contact with nickel whenever possible to reduce the likelihood of nickel allergic contact dermatitis reactions (skin rashes). Repeated contact may result in persistent chronic palmar/hand dermatitis in a smaller number of individuals, despite efforts to reduce or avoid nickel exposure.

Chronic toxicity:

a) Oral: No information available

b) Inhalation: Exposure related toxicities were noted following 13 weeks and two years of exposure to NiO in both rats and mice in the US NTP chronic rat inhalation study.. Adverse effects in rodents were primarily limited to the lung (*e.g.*, increased tissue weight, inflammation, macrophage hyperplasia). The LOAEC from the chronic study in rats was 0.6 mg NiO/m^3 or 0.5 mg Ni/m^3.

c) Dermal: No information available.

Mutagenicity / Reproductive toxicity: Not classified for reproductive/developmental toxicity. Not classified for mutagenicity.

Carcinogenicity:

a) Ingestion: No information available. Not classified

b) Inhalation: Cat. 1A; Human epidemiological and animal data suggest that at least some forms of nickel oxide can be carcinogenic to the respiratory tract of humans after inhalation.

Cobaltous Oxide (CoO)

LD_{50} ORAL RAT: 202 mg/kg

Inhalation: Causes irritation to the respiratory tract, symptoms may include coughing, shortness of breath, and nausea. Respiratory hypersensitivity, asthma may appear. Inhalation of cobalt dust and fumes is associated with an increased incidence of lung disease.

Ingestion: Causes abdominal pain, nausea, vomiting, flushing of the face and ears, mild hypotension, rash, and ringing in the ears. May have cumulative toxic action where elimination cannot keep pace with absorption. Large amounts depress erythrocyte production.

Skin Contact: May cause dermatitis. Cause irritation to skin. Symptoms include redness, itching, and pain.

Eye Contact: Causes irritation, redness, and pain.

Chronic Exposure: Repeated oral administration may produce goiter and reduced thyroid activity. Prolonged or repeated skin exposure may cause dermatitis. Chronic exposure associated with kidney, heart and lung damage.

Pre-existing Conditions: Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Persons with allergies or sensitivity to cobalt may also be more susceptible to the effects of the substance.

Nickel Hydroxide

No information currently available.

12. Ecological Information

12.1	Toxicity	Aquatic Chronic 4. May cause long lasting harmful effects to aquatic life.
12.2	Persistence and degradability	The PBT and vPvB criteria of Annex XIII to the Regulation do not apply to inorganic substances, such as nickel metal. The methods for determining the biological degradability are not applicable to inorganic substances
12.3	Bioaccumulative potential	Nickel does not tend to bioaccumulate or biomagnify in aquatic or terrestrial systems.
12.4	Mobility in soil	The substance is essentially insoluble in water.
12.5	Results of PBT and vPvB assessment	Not classified as PBT or vPvB.
12.6	Other adverse effects	None anticipated.

13. Disposal Considerations

13.1	Waste treatment methods	Recover or recycle if possible. Dispose of contents in accordance with local, state or national legislation.
13.2	Additional Information	No information available.

14. Transport Information

International Maritime Dangerous Goods Code	Not regulated.
International Civil Aviation Organization Technical Instructions for the Carriage of Dangerous Goods by Air	Not regulated.
U.S. Dept. of Transportation Regulations	Not regulated.
Canadian Transportation of Dangerous Goods Act	Not regulated.
European Agreement Concerning the International Carriage of Dangerous Goods by Road	Not regulated.

15. Regulatory Information

Europe:
Classification according to Dangerous Substance Directive 67/548/EEC
T- Toxic- Category 1 carcinogen
R48/23 - Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R49 - May cause cancer by inhalation.
R43 - May cause sensitization by skin contact.
R53 - May cause long-term adverse effects in the aquatic environment.

S53 - avoid exposure - obtain special instructions before use
S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
S61 - avoid release to the environment. Refer to special instructions/safety data sheets

All components are listed on EINECS. (European Inventory of Existing Chemical Substances)

Classification according to Part 3 of Annex VI of EU Regulation No. 1272/2008
Skin Sensitization – Category 1
Carcinogenicity – Category 1A
Specific Target Organ Toxicity, Repeated exposure – Category 1
Aquatic Chronic – Category 4

Symbols: GHS07 - Exclamation mark, GHS08 - Health Hazard


Signal Word: Danger

Hazard Statements:
H317 - May cause an allergic skin reaction.

H350 - May cause cancer by inhalation
H372 - Causes damage to lungs through prolonged or repeated inhalation exposure
H413 - May cause long lasting harmful effects to aquatic life.

Precautionary Statements:
Prevention:
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust or fume
P261 - Avoid breathing dust or fume
P264 - Wash hands, and face thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P272 - Contaminated work clothing should not be allowed out of the workplace.
P273 - Avoid release to the environment.
P280 - Wear protective gloves and protective clothing
P281 - Use personal protective equipment as required

Response:
P302+P352 - If on skin: Wash with plenty of soap and water.
P308+P313 - If exposed or concerned: Get medical advise/attention
P333+P313 - If skin irritation or rash occurs: Get medical advice/attention.
P314 - Get medical advice/attention if you feel unwell.
P321 - See Safety Data Sheet for specific treatment
P363 - Wash contaminated clothes before reuse

Storage:
P405 - store locked up

Disposal:
P501 - Dispose of contents/container in accordance to local/regional/national/international regulations

Canada:
WHMIS Classification: D2A
All components are listed on the Canadian Domestic Substances List (DSL)

United States of America:
Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200)
This product contains *NICKEL* which is subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40 CFR 372. Refer to the Hazardous Ingredients section of this MSDS for the appropriate CAS numbers and percent by weight.
All components are listed on the US Toxic Substances Control Act (TSCA) inventory

Australia:
Classified as Hazardous according to ASCC criteria
All components are listed on the Australian Inventory of Chemical Substances (AICS)

P.R. Korea:
All components are listed in the Korean Toxic Substances Control Act inventory; KE-25818

Philippines:
All components are listed in the Philippine Inventory of Chemicals and Chemical Substances (PICCS)

Japan:

All components are listed in the Japanese Handbook of Existing and New Chemical Substances.

P.R. China:
All components are listed in the Inventory of Existing Substances in China (IECSC).

16. Other Information

The following acronyms may be found in this document:

ACGIH	American Conference of Governmental Industrial Hygienists
DNEL	Derived No Effect Level
LTEL	Long Term Exposure Limit
LR	Lead Registrant
MMAD	Mass Median Aerodynamic Diameter
NIOSH	National Institute of Occupational Safety and Health
OEL	Occupational Exposure Limits
OR	Only Representative
OSHA	Occupational Safety and Health Administration
PBT	PBT: Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
STEL	Short Term Exposure Limit
STOT	Specific Target Organ Toxicity
TLV-TWA	Threshold Limit Value – Time Weighted Average
vPvB	very Persistent and very Bioaccumulative
WEL	Workplace Exposure Limit (UK HSE EH40)

Safety Data Sheet prepared by:
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SDS available online at http://nickel.vale.com/

Note:
Vale Canada believes that the information in this Material Safety Data Sheet is accurate. However, Vale Canada makes no express or implied warranty as to the accuracy of such information and expressly disclaims any liability resulting from reliance on such information.

1. Threshold Limit Values of the American Conference of Governmental Industrial Hygienists. 2008.
2. Maximum Exposure Limit of the Health and Safety Executive in the U.K. in EH40/00.

ANNEX 1 – Exposure Scenarios

Exposure Scenarios can be obtained by clicking on the following link: Vale Nickel Oxide Exposure Scenarios. Exposure Scenarios are listed on the page according to GES # and by language.

If you are unable to retrieve the document or have difficulties, please contact one of the following email addresses for assistance: REACH@vale.com or msds@vale.com

GES 2 - Industrial use of powdered and shaped nickel oxide containing catalysts (A)
GES 3 - Industrial use of nickel oxide-containing catalysts for the production of catalysts containing other nickel compounds (B)
GES 4 - Production of nickel based powders from nickel oxide
GES 5 - Production of nickel-containing electronics and thermally functioning ceramics
GES 6 - Production of nickel-containing enamel frits
GES 7 - Production of nickel-containing pigments
GES 8 - Production of nickel-containing glass
GES 9 - Stainless, special steels and special alloys manufacturing